

## ORIGINAL RESEARCH

# Evaluation of Association of Obesity and Blood Glucose Levels in Periodontitis – A Clinicobiochemical Study

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## ABSTRACT

**Introduction:** Periodontitis is an inflammatory disease of oral cavity and its progression is modified by various risk factors like obesity.

**Aim:** The aim of this study was as follows: (a) To evaluate the association of obesity with blood glucose level and (b) to evaluate the association of obesity and blood glucose level with periodontitis.

**Materials and Methods:** The study was conducted in the Department of Periodontology, Mansarovar Dental College, Bhopal. A total of 150 cases were examined (50 patients were non-obese and 50 patients were overweight and 50 obese) in 1-month clinical study. Periodontal status of the subjects was recorded. Body mass index was used as measure to assess obesity. Random blood sugar level was measured.

**Results:** The result showed that among 150 cases, distribution of presence and absence of periodontitis among normal, overweight, and obese participants is that of 50 normal participants, only 10% were suffering from periodontitis, 50% of overweight participants showed the presence of periodontitis, but higher prevalence of periodontitis (68%) was shown by obese participants. Moreover, on the basis of the mean values of blood sugar level, there was increased blood sugar level among obese participants in comparison to normal and overweight. The difference was found to be highly significant ( $P = 0.001$ ) between the three groups.

**Conclusion:** Obesity is a significant predictor for the risk of periodontal disease. Hence, periodontists should take obesity-related health problems into account during treating periodontitis.

**Keywords:** Blood glucose, Body mass index, Obesity, Periodontitis.

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## INTRODUCTION

Obesity is an increase amount of body fat in relation to body mass, to the extent that health is impaired.<sup>[1]</sup> The global obesity epidemic has been described by the World Health Organization (WHO) (2002) as one of the most obviously noticeable, but yet most neglected, public health problems that hover to overpower both more and less developed countries.<sup>[2]</sup> Thus, in a relatively short span of time, the prevalence of obesity among adults has increased in double amount, and the prevalence of overweight among children and adolescents has tripled.<sup>[1]</sup> This is an alarm for public health, as excess bodyweight is now the sixth important risk factor contributing to disease worldwide such as arteriosclerosis, cardiovascular and cerebrovascular complications, diabetes mellitus (DM), cancer, osteoarthritis, hyperlipidemia, hypertension, and gallbladder disease. And thus obesity may become one of a chief cause in a deterioration of life expectancy in the future.<sup>[3]</sup> Obesity has also been proposed to be a risk factor for periodontitis. Investigation from the United States, by means of the large National Health and Nutrition Examination Survey III database, supported a relationship between body fat and periodontal disease.<sup>[3]</sup> Obesity is attributed as a low-grade systemic inflammatory disease. Obese children and adults have elevated serum levels of C-reactive proteins, interleukin (IL)-6, tumor necrosis factor- $\alpha$ , and leptin, which are well-known as markers of inflammation and are said to be closely associated with chronic inflammatory diseases.<sup>[4]</sup> The two-way relationship between DM and periodontal disease has been looked over intensively in the past.<sup>[5,6]</sup> In studies done in the earlier, it has been shown that blood glucose level is positively associated with periodontal disease.<sup>[7]</sup> However, the association between periodontal disease and glucose blood level is reflected more significantly in the extreme conditions. Studies have also shown that in patients with severe periodontal disease, there is increasing difficulty in controlling blood glucose levels and patients with uncontrolled glucose levels were associated with severe periodontal destruction.<sup>[8]</sup> Thus, the aim of the present study was to investigate the association between overweight/obesity, blood glucose level, and periodontal disease among the patients coming to the Department of Periodontology, Mansarovar Dental College, Bhopal.

## MATERIALS AND METHODS

### Study Sample

#### Inclusion criteria

The study population consisted of convenience and judgment sample of 150 subjects. Of which 50 patients were non-obese, 50 patients were overweight, and 50 were obese. Both male and female patients aged 20–60 years were examined. Patients were systemically healthy subjects.

#### Exclusion criteria

Patients who were already undertreatment of obesity or underweight patients, known diabetic patients, smokers, patients with a history of any antibiotics or analgesics therapy 3 months before study enrolled, patients who underwent periodontal therapy for the past 6 months, physically and mentally challenged patients, and pregnant women and lactating mothers were excluded from the study.

### Clinical Examination

Each subject was examined by a single examiner on a dental chair under proper illumination. A complete intraoral examination was done. All permanent fully erupted teeth, excluding third molars, were examined using a University of North Carolina (UNC) 15 periodontal probe. One Six sites per tooth were assessed in the mesiobuccal, midbuccal, distobuccal, distolingual, midlingual, and mesiolingual sites. In this study, individuals were considered as having periodontitis if they had 30% of their teeth with pocket depth and attachment loss >5 using UNC 15 probe. The height of the participants was measured in centimeters, using a hard ruler installed vertically and secured with a stable base. Weight was assessed in kilograms using two mechanical scales. Random blood glucose level was measured. Patient was sent to the oral pathology department of the college for which ethical approval was been sought and obtained from the institution.

Body mass index (BMI) was calculated as the ratio of the subject's body weight to the square of their height. Four BMI categories were defined using the WHO criteria: Underweight when BMI is <18.5 kg/m<sup>2</sup>, normal

weight when BMI is between 18.5 and 24.9 kg/m<sup>2</sup>, overweight when BMI is between 25 and 29.9 kg/m<sup>2</sup>, and obese when BMI is >30 kg/m<sup>2</sup>. Height (in meters) and weight (in kg) of each patient were recorded<sup>[4]</sup> (Journal:- Overweight and Obesity as Risk Indicators for Periodontitis in Adults).

### Statistical Analysis

The recorded data were compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). The data were found to be normal by Kolmogorov–Smirnov test; hence, parametric test was applied. For comparing mean values of blood glucose level between normal, overweight, and obese population, one-way ANOVA (intergroup comparison) followed by Tukey's test (intragroup comparison) was used as quantitative analysis. For qualitative analysis i.e., normal and increased blood glucose level and also presence and absence of periodontitis among normal, overweight and obese patients level of significance was set at 0.05.

## RESULTS

Table 1 and Graph 1 depict the distribution of the presence and absence of periodontitis among normal, overweight, and obese participants. Of 50 normal participants, only 10% were suffering from periodontitis. 50% of overweight participants showed the presence of periodontitis. However, higher prevalence of periodontitis (68%) was shown by obese participants.

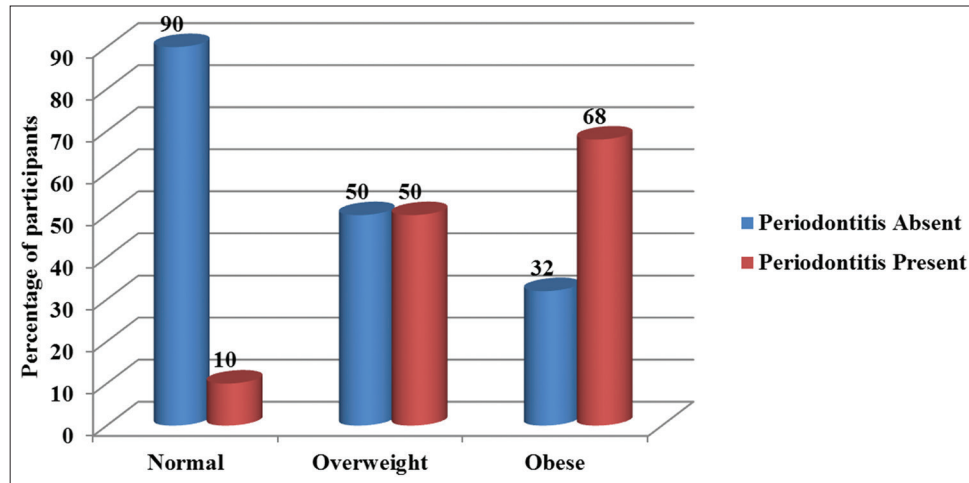
Table 2 and Graph 2 show intergroup and Table 3 and Graph 3 show intragroup comparison, respectively, on the basis of mean values of blood sugar level. There was an increased blood sugar level among obese participants in comparison to normal and overweight. The difference was found to be highly significant ( $P = 0.001$ ) between the three groups.

Table 4 describes the normal and increased blood sugar level between the groups. None of the normal participant had increased blood sugar level. Among overweight, 4% of the participants had increased blood sugar level, but around 28% of the obese participants had increased blood sugar level.

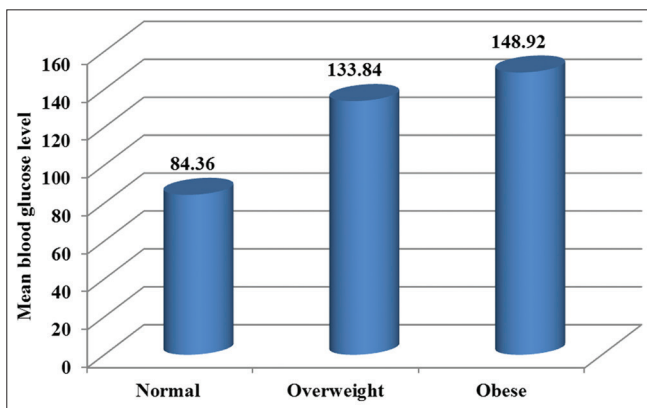
**Table 1:** Relation between the type of obesity with the presence and absence of periodontitis

Obesity	Periodontitis n (%)		Total n (%)	Chi-square value	P value
	Absent	Present			
Normal	45 (90)	5 (10)	50 (100)	36.028	0.001**
Over weight	25 (50)	25 (50)	50 (100)		
Obese	16 (32)	34 (68)	50 (100)		
Total	86 (57.33)	64 (42.67)	150 (100)		

Test applied: Chi-square test; \*\* $P \leq 0.001$  (Highly significant)



**Graph 1:** Graphical representation showing relation between the type of obesity with the presence and absence of periodontitis



**Graph 2:** Graphical representation showing intergroup comparison between obesity groups on the basis of blood glucose level

**Table 2:** Intergroup comparison between obesity groups on the basis of blood glucose level

Obesity	Blood glucose level (mean±SD)	F value	P value
Normal	84.36±11.03	182.131	0.001**
Overweight	133.84±19.70		
Obese	148.92±20.73		

Test applied: One-way ANOVA for intergroup comparison; \*\*P≤0.001 (Highly significant)

**Table 3:** Intragroup comparison between obesity groups on the basis of blood glucose level

Variable 1	Variable 2	Mean difference	Std. error	P value
Normal	Overweight	-49.480	3.539	0.001**
	Obese	-64.560	3.539	0.001**

Test applied: Tukey's test for intragroup comparison; \*\*P≤0.001 (Highly significant)

## DISCUSSION

Obesity is the fastest-growing health-associated issue in the world.<sup>[9]</sup> Being a common metabolic and nutritional disorder, obesity, a multifactorial chronic disease, that progresses from a collaboration of genotype and the environment.<sup>[10]</sup> Overweight and obese adults

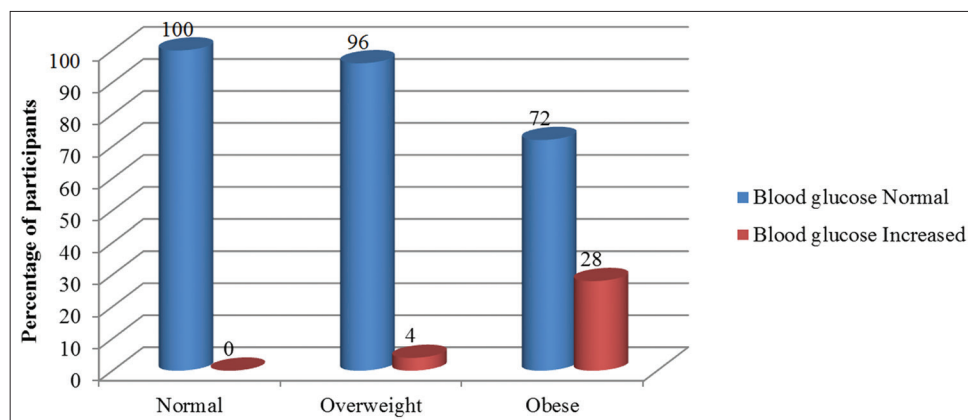
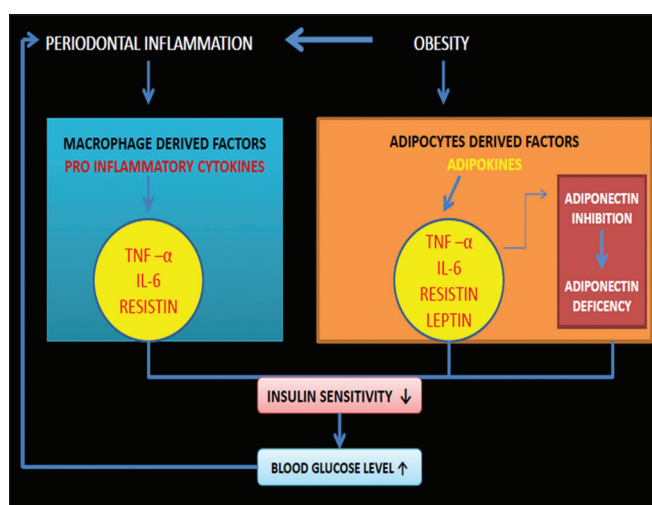
have been attributed to be at high risk for many chronic inflammatory diseases and conditions such as cardiovascular disease, diabetes, and arthritis.<sup>[11]</sup> It has also been suggested that obesity contributes to an overall systemic inflammatory state through its effect on metabolic and immune parameters, thereby increasing susceptibility to periodontal disease.<sup>[12,13]</sup> The immunologic activity of adipose tissue plays a pivotal role both in the development of insulin resistance and in periodontal disease. Several decades ago, obesity was noted to contribute to the severity of periodontal disease in rats.<sup>[14]</sup>

Results of the present study show that the prevalence of periodontal disease was higher in obese subjects (68%) when compared to non-obese subjects (10%), this result was in agreement with the studies issued by Al-Zahrani *et al.*<sup>[3]</sup> The adipose tissue is a complex and metabolically active endocrine organ that secretes several immunomodulatory factors (>50 bioactive molecules called adipokines) and plays an important role in regulating metabolic and vascular biology.<sup>[1]</sup> Recent studies have also proposed that high serum levels of adipocytokines (adiponectin and resistin), leptin, and IL-6 are associated with individuals presenting obesity and periodontitis. These observations show that obesity and periodontitis can, independently or jointly, modify the local and systemic levels of adipocytokines, leading to the vicious cycle of events seen in these individuals.<sup>[15]</sup> The plasminogen-activating system has been shown to play a significant role in gingival inflammation. Plasminogen activator inhibitor-1 has an increased gene expression in visceral fat and induces agglutination of blood, may reduce periodontal blood flow in obesity, promoting initiation of periodontitis. All these are the probable mechanisms (Figure 1) underlying the periodontitis-dyslipidemia relationship in obese individuals.<sup>[4]</sup>

**Table 4:** Comparison between the obesity groups on the basis of normal and increased blood glucose level

Category		Blood glucose n (%)		Total n (%)	Pearson Chi-square value	P value
		Normal	Increased			
Obesity	Normal	50 (100)	0	50 (100)	24.067	0.001**
	Overweight	48 (96)	2 (4)	50 (100)		
	Obese	36 (72)	14 (28)	50 (100)		
Total		134 (89.33)	16 (10.67)	150 (100)		

Test applied: Chi-square test; \*\* $P \leq 0.001$  (Highly significant)

**Graph 3:** Graphical representation showing intragroup comparison between obesity groups on the basis of blood glucose level**Figure 1:** Diagrammatic representation of mechanism of periodontitis, blood glucose, and dyslipidemia

Second, in this study, it was also found that in subjects with low BMI ( $<30 \text{ kg/m}^2$ ), there is no influence on blood glucose level (70–150 mg%). Only in subjects with a high BMI ( $>30 \text{ kg/m}^2$ ) the effect on mean glucose levels was observed to be increased i.e. ( $>150 \text{ mg\%}$ ). Similar results were shown in studies done by Katz *et al.*, 2001.<sup>[8]</sup>

Our study also found that patients with increased random blood sugar (RBS) ( $>150 \text{ mg\%}$ ), i.e., 28% of total obese developed periodontitis than the ones with normal RBS which commensurate with the studies done earlier by Chang *et al.*, in 1999<sup>[5]</sup> and Katz, in 2000.<sup>[7]</sup> The possible reason is decrease of host resistance in periodontitis which enhances bacterial infection producing insulin resistance thus causing increased blood glucose levels in patients.<sup>[16]</sup>

## CONCLUSION

Results from analysis indicate that obesity is a significant predictor for risk of periodontal disease. Hence, periodontists need to be aware of the potential health problems related to obesity and increase blood glucose level and should take them into account during treatment. Periodontists should counsel obese persons regarding the possible oral complications of obesity and abnormal blood glucose level. Finally, intervention and prevention approaches may ultimately lead to amelioration of the significant health burden associated with obesity, elevated blood glucose levels, and periodontitis.

## REFERENCES

- Ritchie CS. Obesity and periodontal disease. *Periodontol* 2000;44:154-63.
- Mathur LK, Manohar B, Shankarapillai R, Pandya D. Obesity and periodontitis: A clinical study. *J Indian Soc Periodontol* 2011;15:240-4.
- Al-Zahrani MS, Bissada NF, Borawskit EA. Obesity and periodontal disease in young, middle-aged, and older adults. *J Periodontol* 2003;74:610-5.
- Wood N, Johnson RB, Streckfus CF. Comparison of body composition and periodontal disease using nutritional assessment techniques: Third national health and nutrition examination survey (NHANES III). *J Clin Periodontol* 2003;30:321-7.
- Chang CJ, Kao JT, Wu TJ, Lu FH, Tai TY. Serum lipids and lipoprotein(a) concentrations in chinese NIDDM patients. Relation to metabolic control. *Diabetes Care* 1995;18:1191-4.
- Cutler CW, Shinedling EA, Nunn M, Jotwani R, Kim BO, Nares S, *et al.* Association between periodontitis and

- hyperlipidemia: Cause or effect? *J Periodontol* 1999;70:14429-34.
7. Katz J, Peretz B, Sgan-Cohen HD, Horev T, Eldad A. Periodontal status by CPITN, and associated variables in an Israeli permanent force military population. *J Clin Periodontol* 2000;27:319-24.
  8. Katz J. Elevated blood glucose levels in patients with severe periodontal disease. *J Clin Periodontol* 2001;28:710-2.
  9. Haenle MM, Brockmann SO, Kron M, Bertling U, Mason RA, Steinbach G, et al. Overweight, physical activity, tobacco and alcohol consumption in a cross-sectional random sample of German adults. *BMC Public Health* 2006;6:233.
  10. Dennison EM, Syddall HE, Aihie Sayer A, Martin HJ, Cooper C, Hertfordshire Cohort Study Group, et al. Lipid profile, obesity and bone mineral density: The hertfordshire cohort study. *QJM* 2007;100:297-303.
  11. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: Executive summary. Expert panel on the identification, evaluation, and treatment of overweight in adults. *Am J Clin Nutr* 1998;68:899-917.
  12. Genco RJ, Grossi SG, Ho A, Nishimura F, Murayama Y. A proposed model linking inflammation to obesity, diabetes, and periodontal infections. *J Periodontol* 2005;76:2075-84.
  13. Van Dyke TE. Inflammation and periodontal diseases: A reappraisal. *J Periodontol* 2008;79:1501-2.
  14. Perlstein MI, Bissada NF. Influence of obesity and hypertension on the severity of periodontitis in rats. *Oral Surg Oral Med Oral Pathol* 1977;43:707-19.
  15. Zimmermann GS, Bastos MF, Dias Gonçalves TE, Chambrone L, Duarte PM. Local and circulating levels of adipocytokines in obese and normal weight individuals with chronic periodontitis. *J Periodontol* 2013;84:624-33.
  16. Grossi SG, Genco RJ. Periodontal disease and diabetes mellitus: A two-way relationship. *Ann Periodontol* 1998;3:51-61.